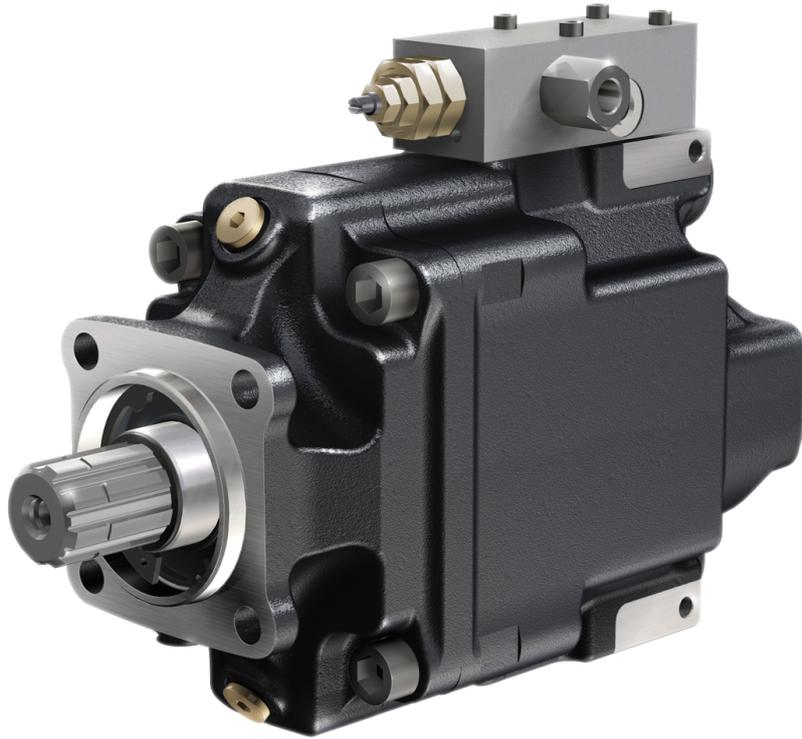




Bulletin HY30-5508-M1/UK

Service Manual Series VP1

Effective: August, 2016
Supersedes: January, 2013



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Conversion factors

1 kg	= 2.2046 lb
1 N	= 0.22481 lbf
1 bar	= 14.504 psi
1 l	= 0.21997 UK gallon
1 l	= 0.26417 US gallon
1 cm ³	= 0.061024 in ³
1 m	= 3.2808 feet
1 mm	= 0.03937 in
9/5 °C + 32	= °F

 **WARNING**

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Design

Large angle - compact design

The pump design permits a large angle, 20°, between piston and slipper shoe/swashplate, providing compactness and small outer dimensions.

Tandem coupling on VP1-045/075

The through shaft permits tandem coupling of a second pump, such as a series F1 fixed displacement pump.

Accepts external shaft loads

Heavy duty roller bearings allow radial loads to the VP1 shaft end which makes it possible to install a gear directly on the shaft without additional bearings.

Long life

The VP1 is designed for load sensing systems. It is sturdy, yet simple, with few moving parts. The result is a reliable pump with long service life.

Floating valve plate on VP1-045/075

The design of the VP1 includes a so called 'floating valve plate'. The valve plate 'floats' on five pistons which results in a quieter operating pump with low internal leakage and high volumetric efficiency.

High overall efficiency

Uniquely designed parts like the piston/slipper shoe and floating valve plate minimize mechanical losses and internal leakage, providing a very high overall efficiency.

Retainer plate

The retainer plate (refer to the cross section illustration on page 4) is of a heavy duty design which makes the pump withstand high shaft speeds and fast speed and flow changes.

The VP1 is the worlds first variable displacement pump for truck applications. It can be close-coupled to the power take-off and is especially designed and optimized for truck hydraulic systems that will benefit from variable flow.

Truck cranes is an application that fully utilizes the benefits of a load-sensing system. The complex systems of refuse collection vehicles and sewage trucks as well as various combinations of tipper, crane, snow ploughs and salt/sand spreader can also be greatly simplified and optimized with the VP1 pump.

The VP1 provides the hydraulic system with the correct amount of fluid at precisely the right moment, effectively reducing energy consumption and heat generation. This means a smoother and quieter running system with much reduced impact on the environment.

The VP1 is highly efficient, has a small installation envelop and is extremely light. It is reliable, economical and easy to install.

Shaft and mounting flange follow the European ISO standard 7653-1985.

The VP1 is suitable for all load-sensing systems, regardless of make.

Features

- Variable displacement
- Energy efficiency
- Low noise level
- High power-to-weight ratio
- Compact and light
- Highly efficient
- Sturdy design
- Withstands low temperatures
- High reliability and serviceability



Specifications	VP1-45	VP1-75	VP1-95	VP1-110	VP1-130
Frame size	VP1-45	VP1-75	VP1-95	VP1-110	VP1-130
Max displacement [cm ³ /rev]	45	75	95	110	130
Max Pressure [bar]					
peak	400	400	420	420	420
continuous	350	350	400	400	400
Response time [ms]					
max-to-min	20-30	20-40	30-40	30-40	30-40
min-to-max	90-120	100-140	100-140	100-140	100-140
Selfpriming speed[rpm]					
2" suction line, max	2200	1700	1800 (2 ^{1/2} "	1500 (2 ^{1/2} "	1300 (2 ^{1/2} "
2 ^{1/2} " suction line, max	2400	2200	2200 (3")	2100 (3")	1900 (3")
Control type	LS	LS	LS	LS	LS
Splined shaft end	DIN 5462	DIN 5462	DIN 5462	DIN 5462	DIN 5462
Mounting flange	ISO 7653-1985	ISO 7653-1985	ISO 7653-1985	ISO 7653-1985	ISO 7653-1985
Weight (with control) [kg]	27	27	27	27	27

Ordering information

Example: **VP1-045-L**

Frame size
045, 075, 095, 110 or 130

Direction of rotation: **L**-Left hand, **R**-Right hand

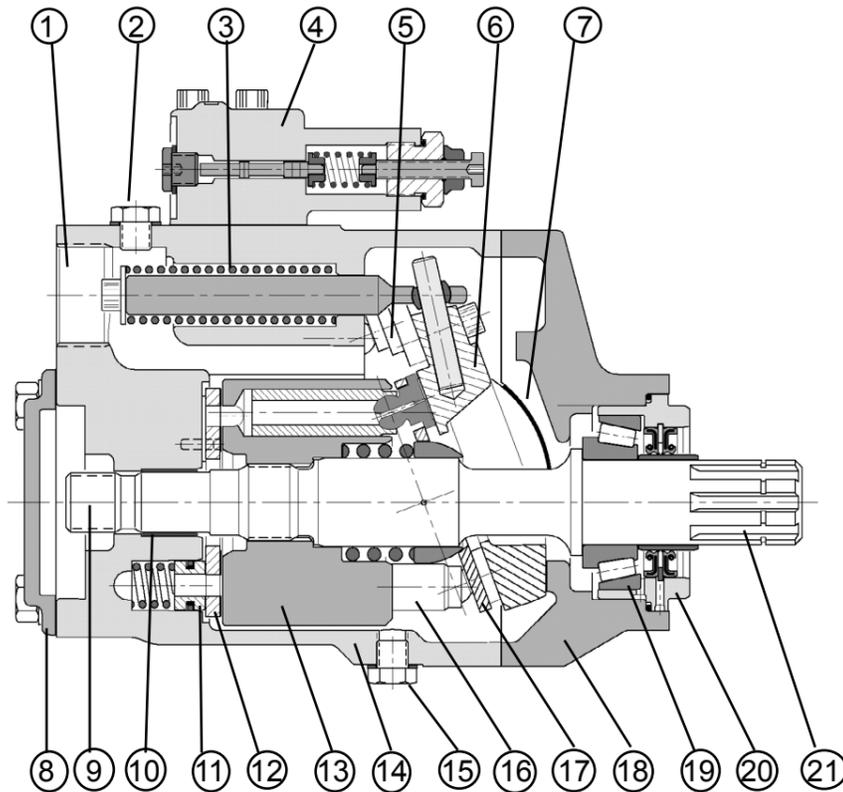
The VP1 is uni-directional. Consequently, the desired direction of rotation must be stated when ordering.

Standard model numbers

- VP1-045-R 3780334
- VP1-045-L 3780335
- VP1-075-R 3780336
- VP1-075-L 3780337
- VP1-095-R 3786000
- VP1-095-L 3786001
- VP1-110-R 3784110
- VP1-110-L 3784111
- VP1-130-R 3784500
- VP1-130-L 3784501

VP1 45 / 75 cross section

1. Inlet port
2. 'Top' purge plug
3. Return spring
4. Control
5. Setting piston (one of two)
6. Swash plate
7. Bearing shell
8. End cover
9. Spline (auxiliary pump mounting)
10. Plain bearing
11. Hold-down plunger
12. Bi-metal valve plate
13. Cylinder barrel
14. Barrel housing
15. 'Bottom' purge plug
16. Piston with piston shoe
17. Retainer plate
18. Bearing housing
19. Roller bearing
20. Shaft seals with carrier
21. Input shaft



Installation and start-up

Direction of rotation

The basic VP1 pump is uni-directional; there is a left hand and right hand version (indicated by the arrow on the side of the VP1 pump fig. 4 and 5). Consequently, the required direction of rotation must be stated when ordering the pump.

Installation

The VP1 can be installed (close-coupled) directly to a PTO (when manufactured according to ISO DIN 5462).

The pump can be located in any position. Before start-up, the pump must be purged; utilize the uppermost purge plug (fig. 6).

Figure 7 shows two ways of installing a gear on the VP1 shaft. On a non-geared or a geared PTO with support bearings, the pump shaft is usually installed directly in the internally splined PTO output shaft.

IMPORTANT

Force must *never* be used when installing a coupling, a sleeve or a gear on the VP1 pump shaft.

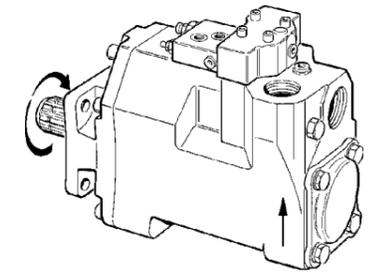


Fig. 4. Left hand rotating pump.

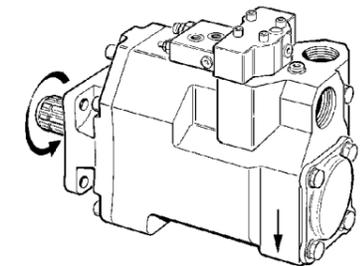


Fig. 5. Right hand rotating pump.

Before start-up, open the 'bottom' plug, purge the pump, then tighten the plug. Before start-up, open the 'top' plug, purge the pump, then tighten the plug.

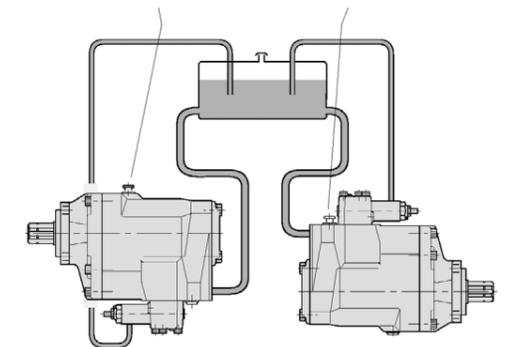


Fig. 6. VP1 should be installed below the reservoir fluid level.

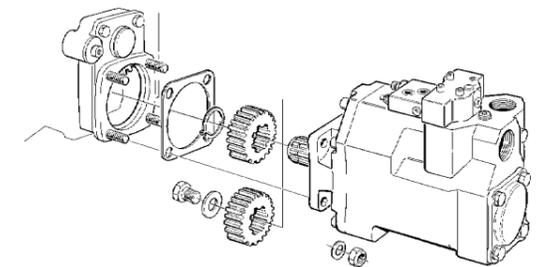
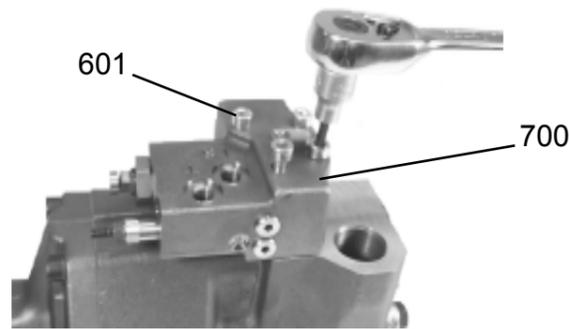
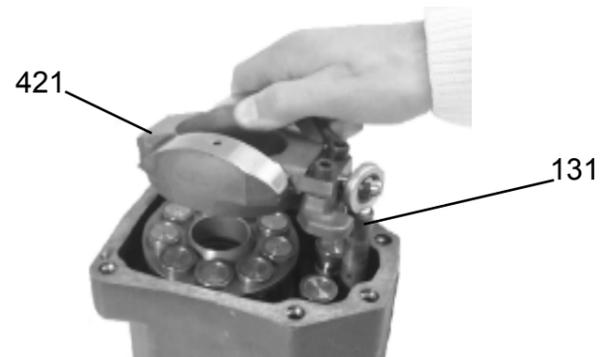


Fig. 7. VP1-to-PTO installation.

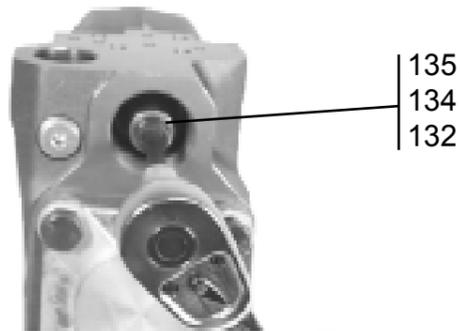
Disassembling VP1-045/075



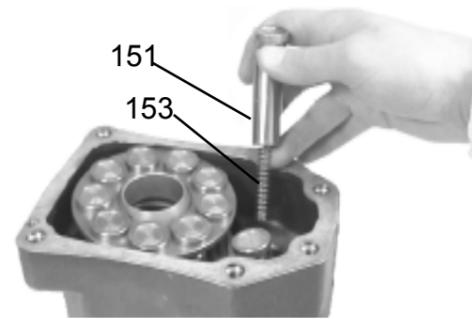
1. Remove the LS Control (item 700).



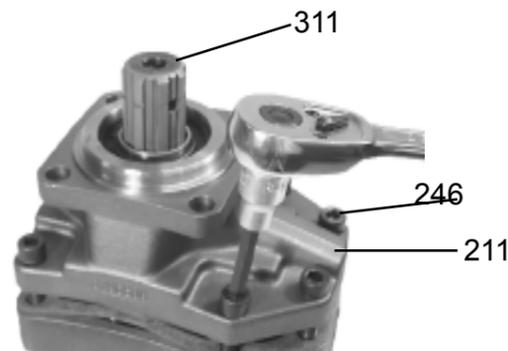
4. Remove the Swashplate (item 421) with Bar Assy (item 131).



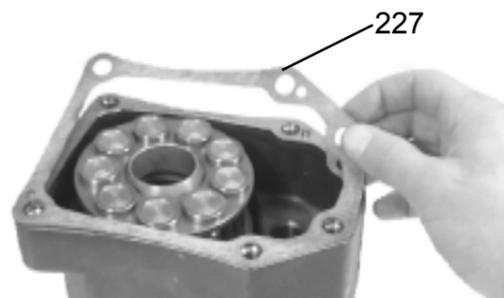
2. Remove the Hex S Screw (item 135), the Washer (item 134) and the Compression Spring (item 132). **Note!** The Bar is loctited with the Pivot Head and it might come loose when removing the Hex S Screw (item 135).



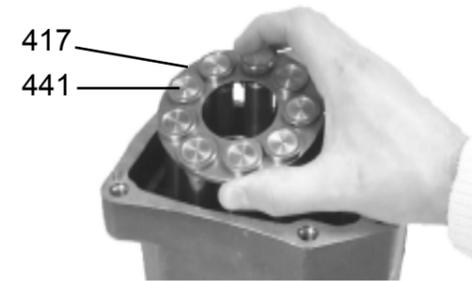
5. Remove the Setting Piston (item 151) and the Compression Springs (item 153).



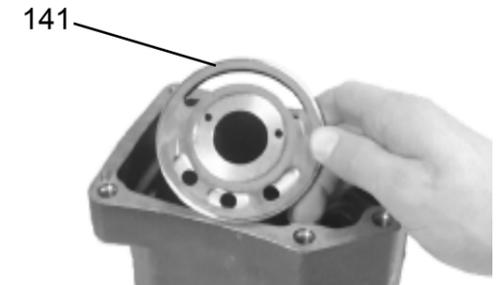
3. Remove the six Hex S Screws (item 246) and lift up the Shaft (item 311) with Bearing Housing (item 211).



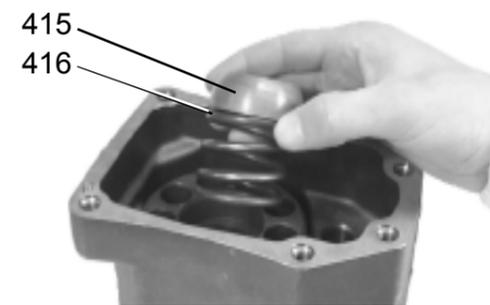
6. Remove the Gasket (item 227).



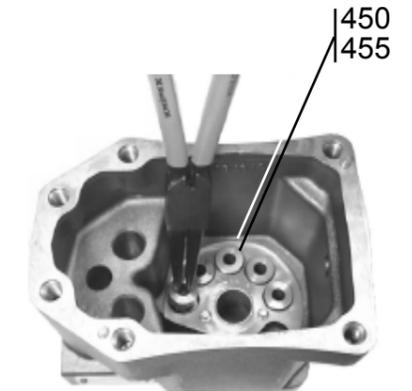
7. Remove the Plate (item 417) with Pistons (item 441).



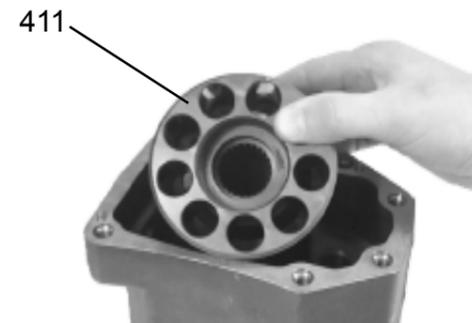
10. Remove the Valve Plate (item 141).



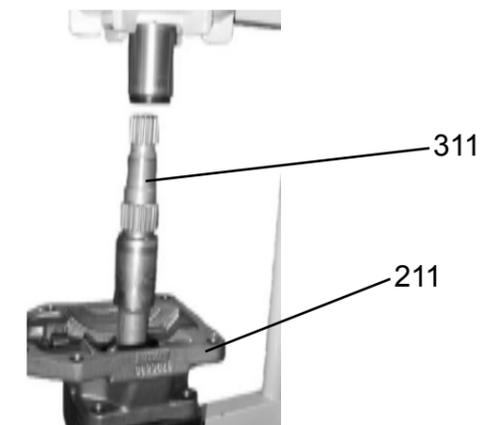
8. Remove the Ball (item 415) and the Compression Spring (item 416).



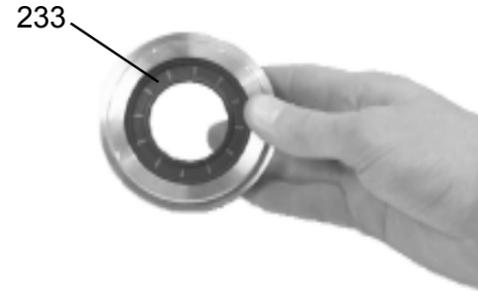
11. Remove the Bushes (item 450) and the Compression Springs (item 455) fitted under the Bushes.



9. Remove the Cylinder Barrel (item 411).



12. Place the Bearing Housing (item 211) on a tube (inside diameter 95 - 110mm) so that the Shaft (item 311) with Seal Carrier (item 231) can be pressed off. Press on the small shaft end. Remove the O-ring (item 225) from the Bearing Housing.



14. Remove the Shaft Seal (item 233).

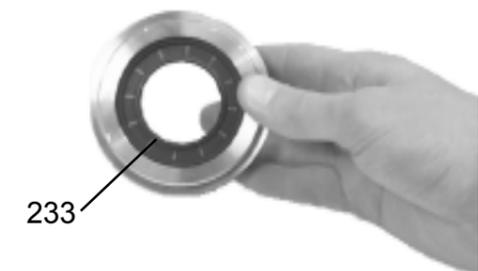
15. Remove the Retaining Ring (item 237). Remove the other Shaft Seal (item 233). If it is necessary to change the Inner Ring (item 471) but not the Bearing (item 470), hit the Inner Ring with a hammer to crack it. Press on a new Inner Ring on the Shaft.

16. If it is necessary to change the Bearing (item 470), disassemble the Bearing (item 470) and the Inner Ring (item 471) from the shaft by pressing the Bearing and Inner Ring off.

Assembling VP1-045/075

1. Install the Bearing (item 470) and the Inner Ring (item 471) on the shaft.

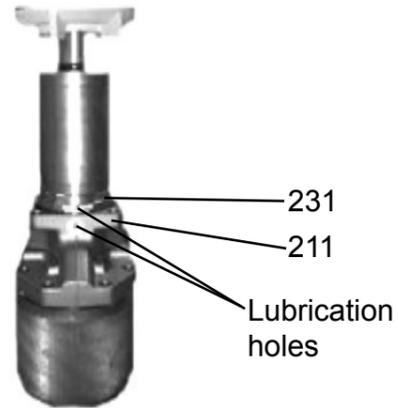
2. Install the Bearing Ring (item 470). Install the first Shaft Seal (item 233) and the Retaining Ring (item 237). **Note!** locate the opening on the Retaining Ring opposite the drain hole in the Seal Carrier.



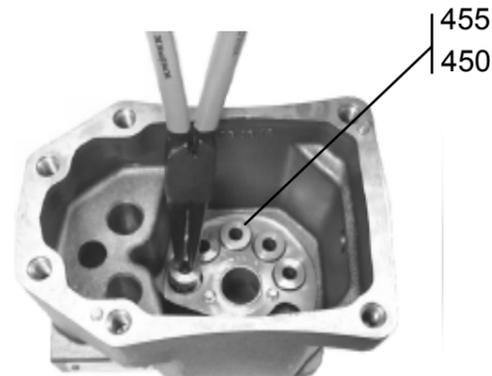
3. Install the other Shaft Seal (item 233).



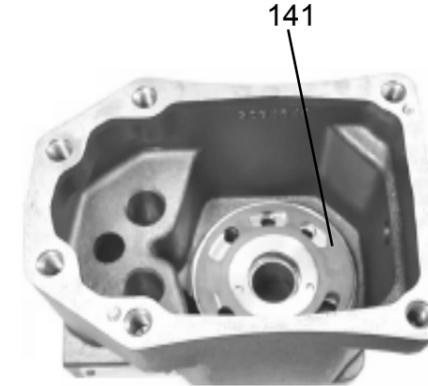
4. Install the Seal Carrier (item 231) on the shaft.



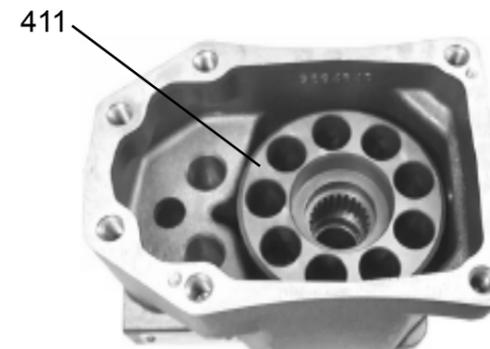
5. Install the O-ring (item 225) in the Bearing Housing (item 211). Install the Shaft with Seal Carrier in the Bearing Housing (item 211). Place the Bearing Housing on a tube (inside diameter 65mm and outside diameter max 80mm) and press down the Shaft with Seal Carrier. Press on the seal carrier and make sure that the lubrication holes are opposite each other.



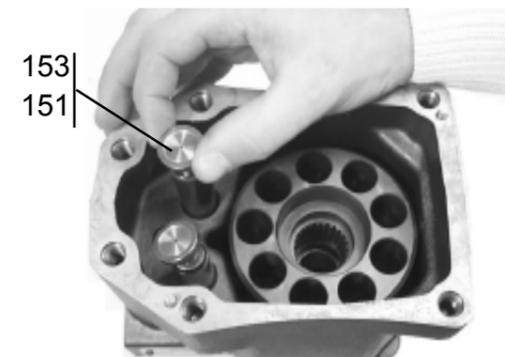
6. Install the Compression Springs (item 455) and the Bushes (item 450).



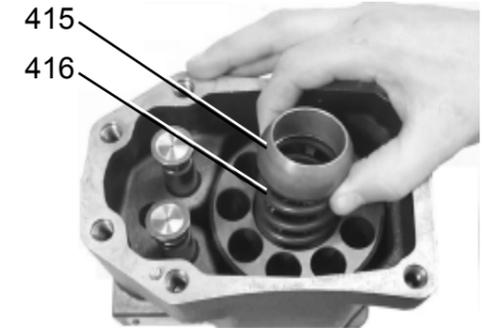
7. Install the Valve Plate (item 141).



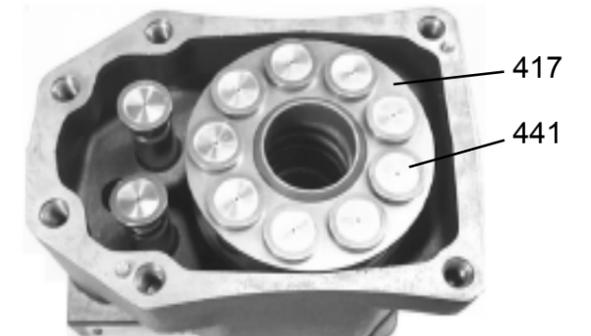
8. Install the Cylinder Barrel (item 411).



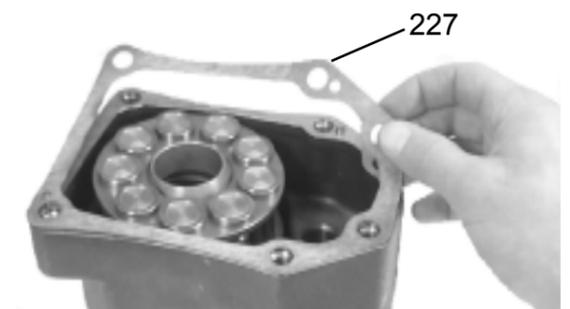
9. Install the Compression Springs (item 153) and the Setting Pistons (item 151).



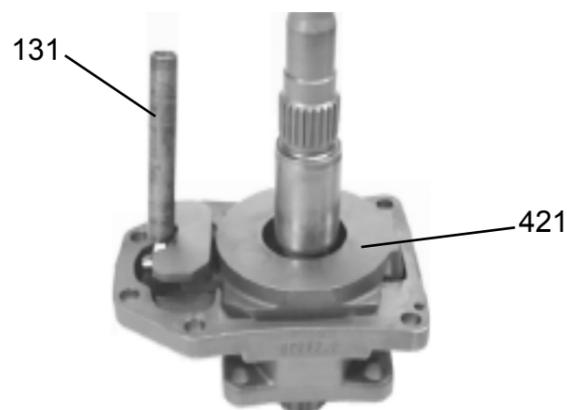
10. Install the Compression Spring (item 416) and the Ball (item 415).



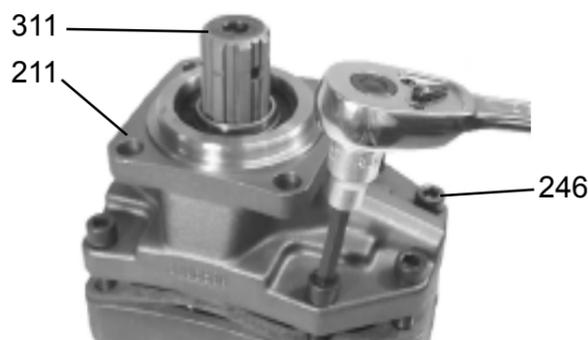
11. Install the Plate (item 417) with Pistons (item 441).



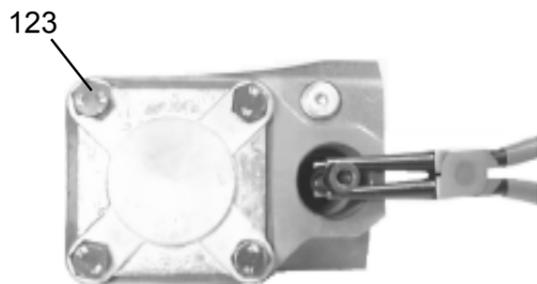
12. Install the Gasket (item 227). **Note!** Use a new Gasket.



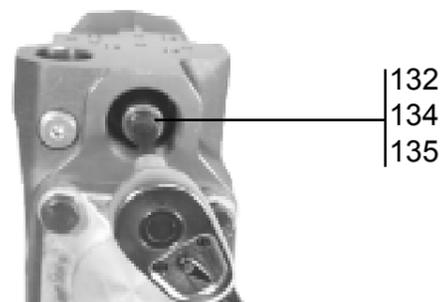
13. Install the Swashplate (item 421) and the Bar Assy (item 131).



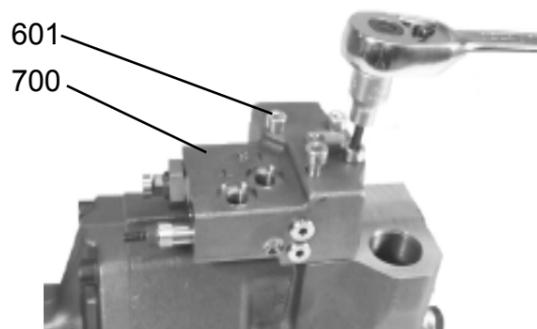
14. Install the Shaft (item 311), Bearing Housing (item 211), Swashplate (item 421) and Bar Assy (item 131). Hold the Swashplate against the Bearing Housing until the Splines on the Shaft enters the splines on the Cylinder Barrel. Assemble the Hex S Screws (item 246) according to the specified tightening torque 60 ± 10 Nm. "Note, to facilitate assembly use two longer screws and push the parts together until you can fit the original screws".



15. Pull out the Bar (item 131) with a long screw.



16. Install the Hex S Screw (item 135) together with the Washer (item 134) and the Compression Spring (item 132) according to the specified tightening torque 30 ± 5 Nm.



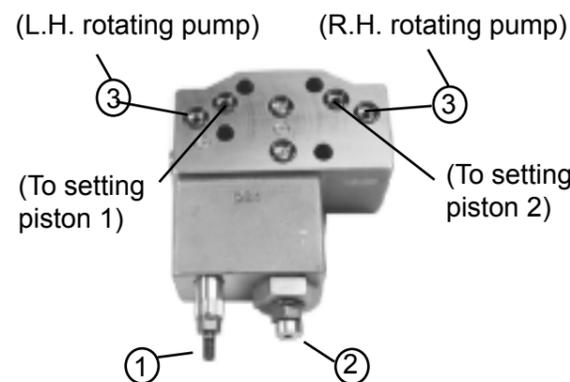
17. Install the LS Control (item 700). Tighten the screws (item 601) to the specified tightening torque 24 ± 5 Nm.

Note! If the Cover (item 121) is removed, install the Cover with a new Gasket (item 122) and the Screws (item 123) according to the specified tightening torque 60 ± 10 Nm.

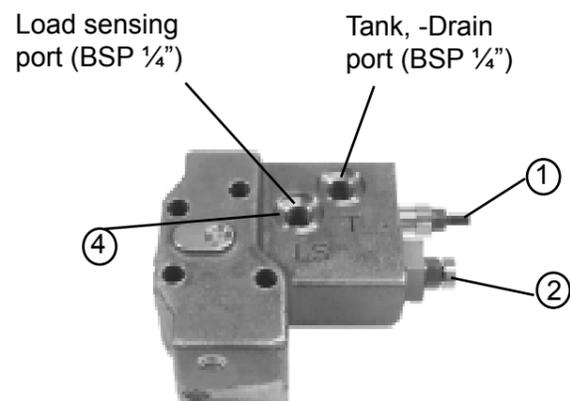
Tightening Torques

Item	Tightening Torque	
246	60 ± 10	Nm
135	30 ± 5	Nm
123	60 ± 10	Nm
601	24 ± 5	Nm

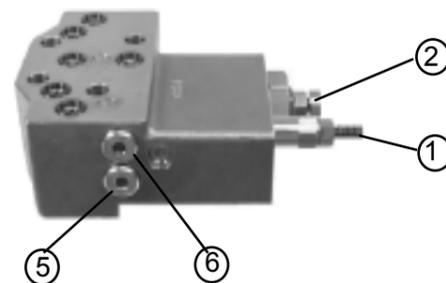
LS Control VP1-045/075



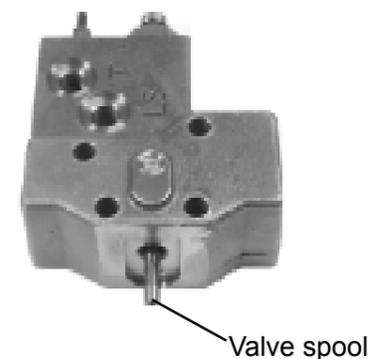
1. Signal pressure limiter adjustment
2. Differential pressure adjustment
3. System pressure dampening nozzle (2.0 mm)



4. Load sensing orifice (1.0 mm; fixed)



5. Return line nozzle (0.6 mm)
6. Bleed-off nozzle (0.6 mm)



LS control adjustments

LS signal pressure limiter

The cartridge is factory set at 350 bar but is adjustable between 200 - 350 bar.

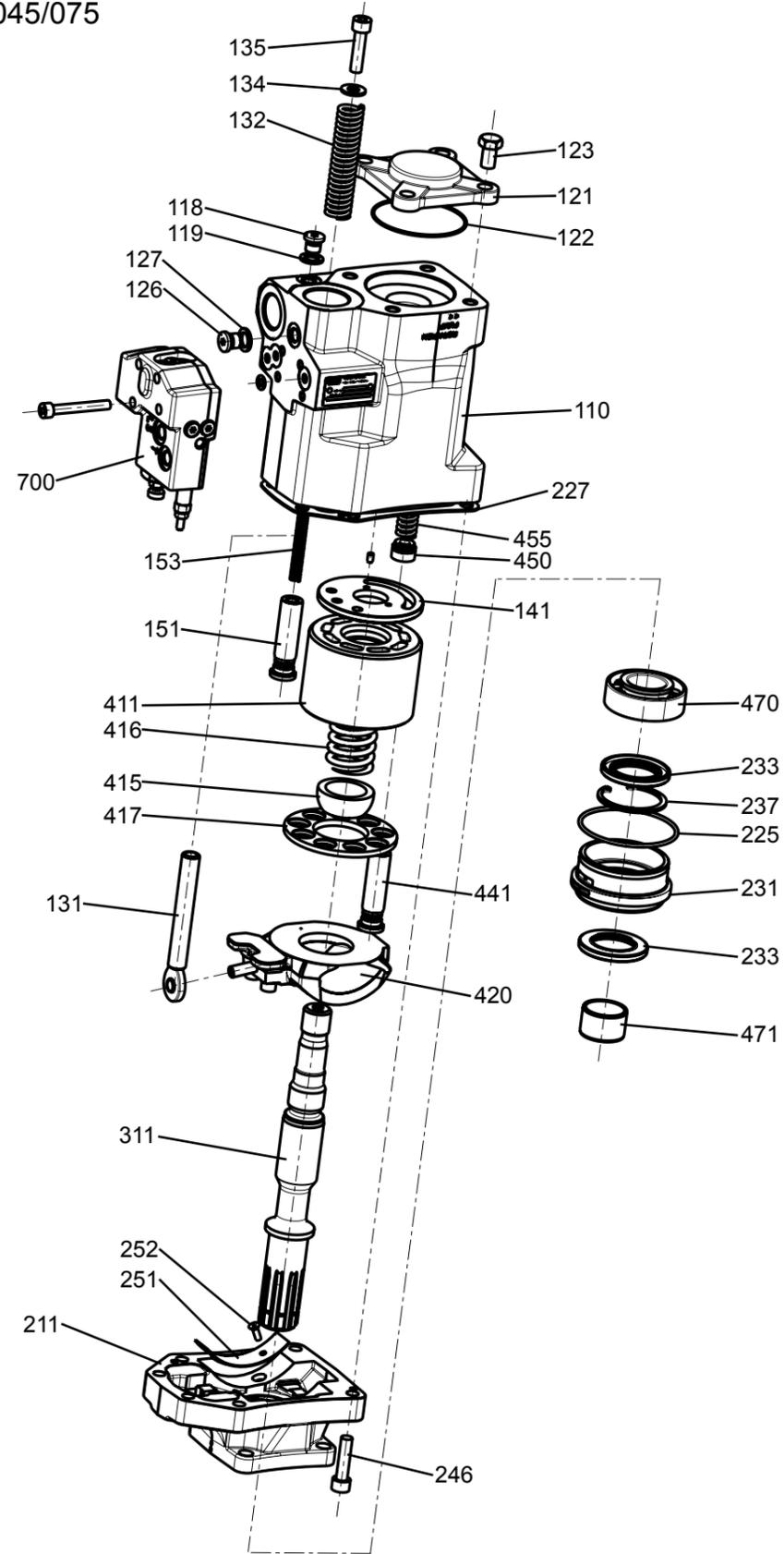
LS load sensing valve

From factory, the Dp (stand by pressure) is set to 25 bar but is adjustable between 20 - 35 bar.

The 25 bar setting and the standard orifice sizes will usually provide an acceptable directional valve characteristic as well as system stability.

For additional information, contact Mobile Controls Division.

Splitview VP1-045/075

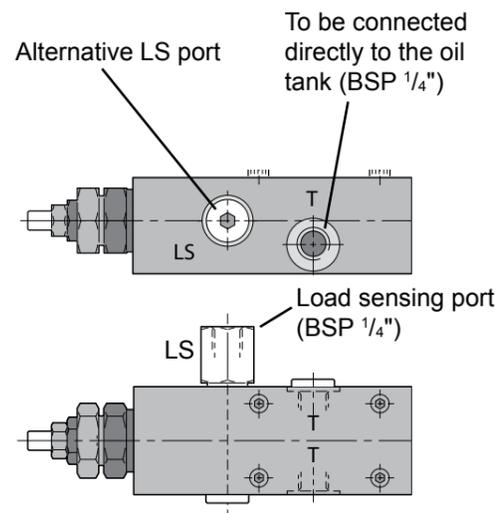
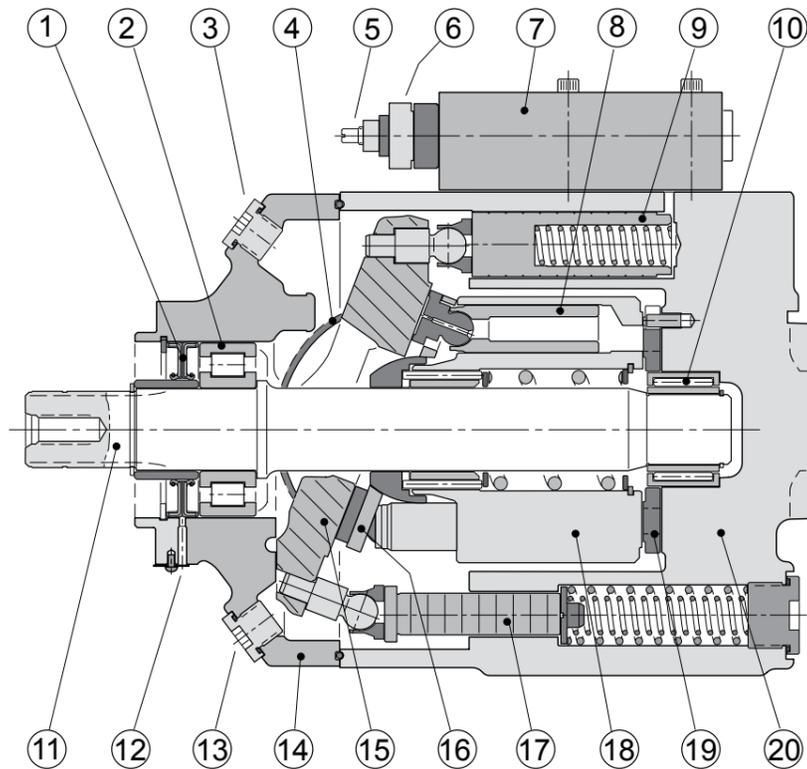


Parts specification VP1-045/075

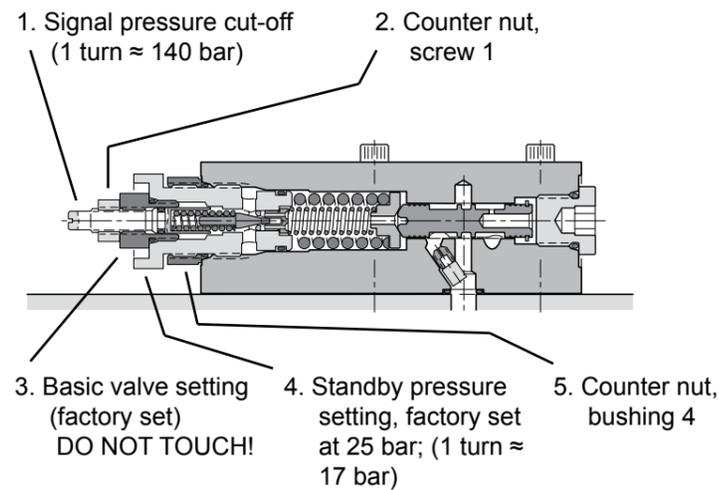
Item	Description
110	Barrel Housing
118	Hex Socket Plug
119	Seal Washer
121	Cover
122	O-ring
123	Hexagon Screw
126	Hex Socket Plug
127	Seal Washer
131	Bar Assy
132	Compression Spring
134	Washer
135	Hex Socket Screw
141	Valve Plate
151	Setting Piston
153	Compression Spring
211	Bearing Housing
225	O-ring
227	Gasket
231	Seal Carrier
233	Shaft Seal
237	Retaining Ring
246	Hex Socket Screw
251	Bearing Shell
252	Sunk Head Screw
311	Shaft
411	Cylinder Barrel
415	Ball
416	Compression Spring
417	Slipper Retainer
420	Swashplate Assy
441	Piston Assy
450	Piston Seal Assy
455	Compression Spring
470	Tapped Roller Bearing
471	Inner Ring
700	Control LS

VP1-095/110/130 cross section

1. Shaft seal
2. Roller Bearing
3. 'Upper' purge plug
4. Bearing shell
5. Setting screw (pressure relief valve)
6. Setting bushing (standby pressure)
7. Control
8. Piston with piston shoe
9. 'Upper' setting piston (control pressure)
10. Needle bearing
11. Shaft
12. Drain hole, shaft seals
13. 'Lower' purge plug
14. Bearing housing
15. Swash plate
16. Retainer plate
17. 'Lower' setting piston (pump pressure)
18. Cylinder barrel
19. Valve plate
20. Barrel housing

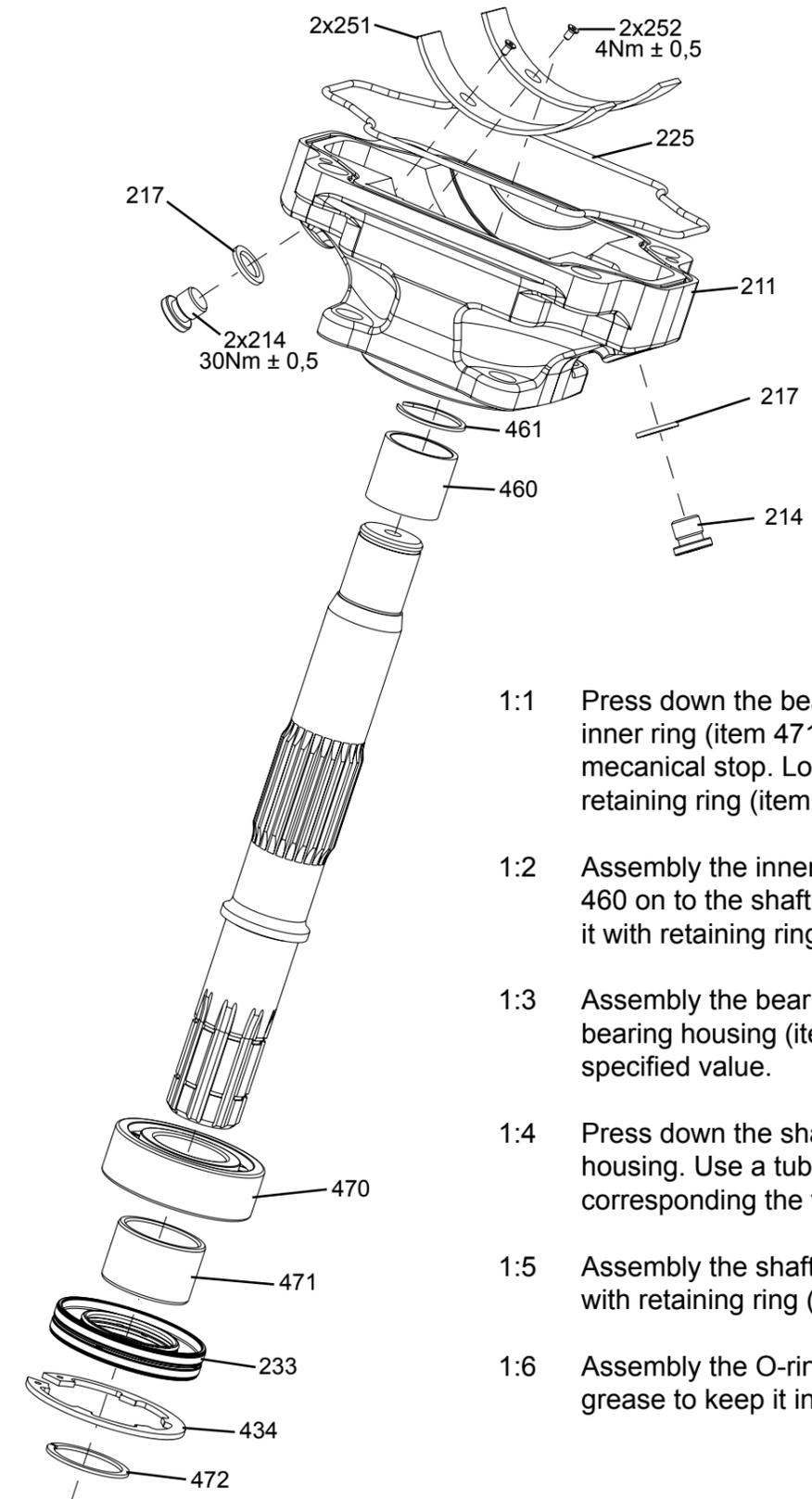


LS control ports.

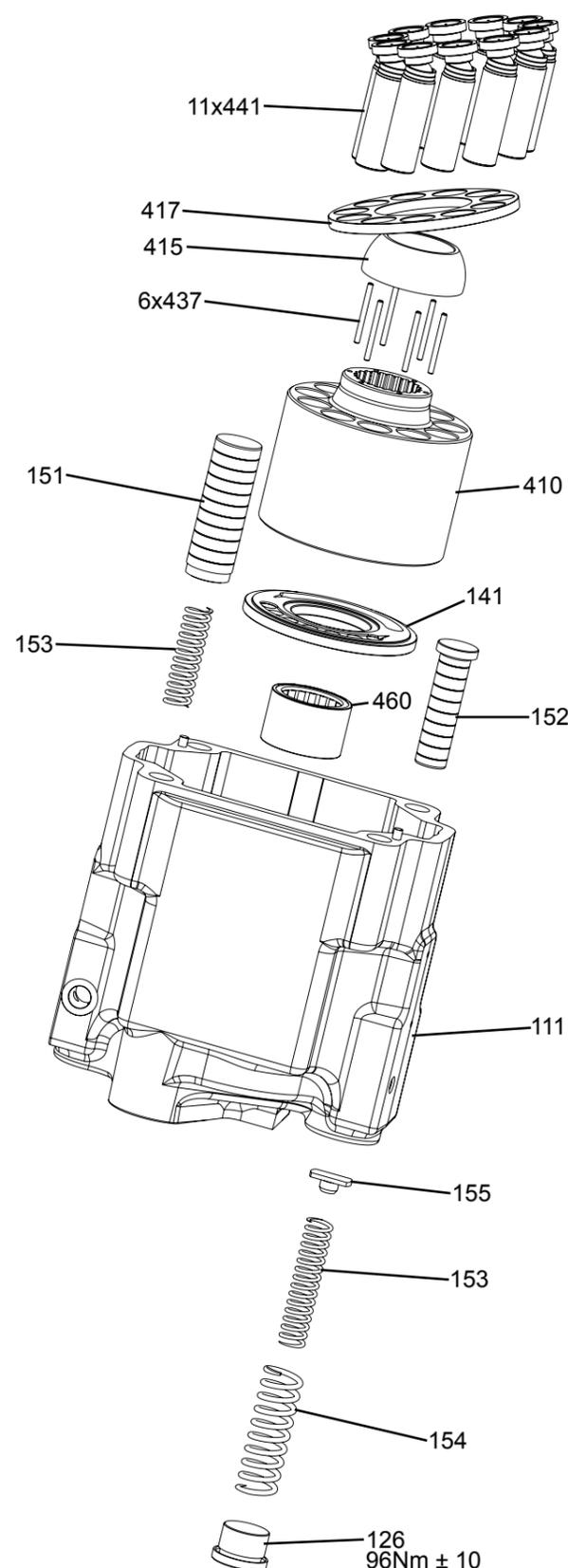


LS control cross section.

Assembling VP1-095/110/130

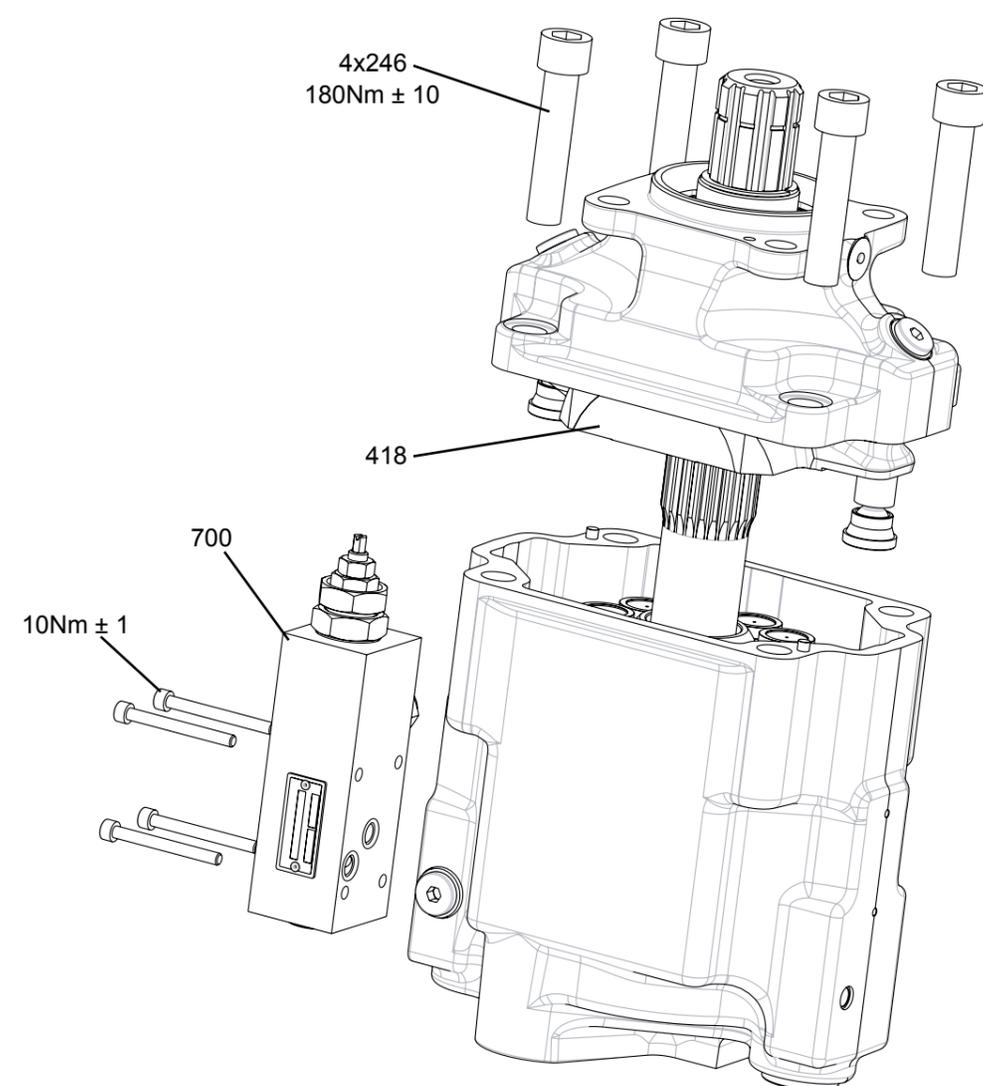


- 1:1 Press down the bearing (item 470) and the inner ring (item 471) on the shaft until mechanical stop. Lock the inner ring with retaining ring (item 472).
- 1:2 Assembly the inner ring from bearing with item 460 on to the shaft (not press fitting) and lock it with retaining ring (item 461).
- 1:3 Assembly the bearing shells (item 251) in the bearing housing (item 211). Torque the screw to specified value.
- 1:4 Press down the shaft assy to the bearing housing. Use a tube with an outer diameter corresponding the the bearing with item 470.
- 1:5 Assembly the shaft seal (item 233) and lock it with retaining ring (item 434).
- 1:6 Assembly the O-ring (item 225). Use some grease to keep it in place.

**Note, danger!**

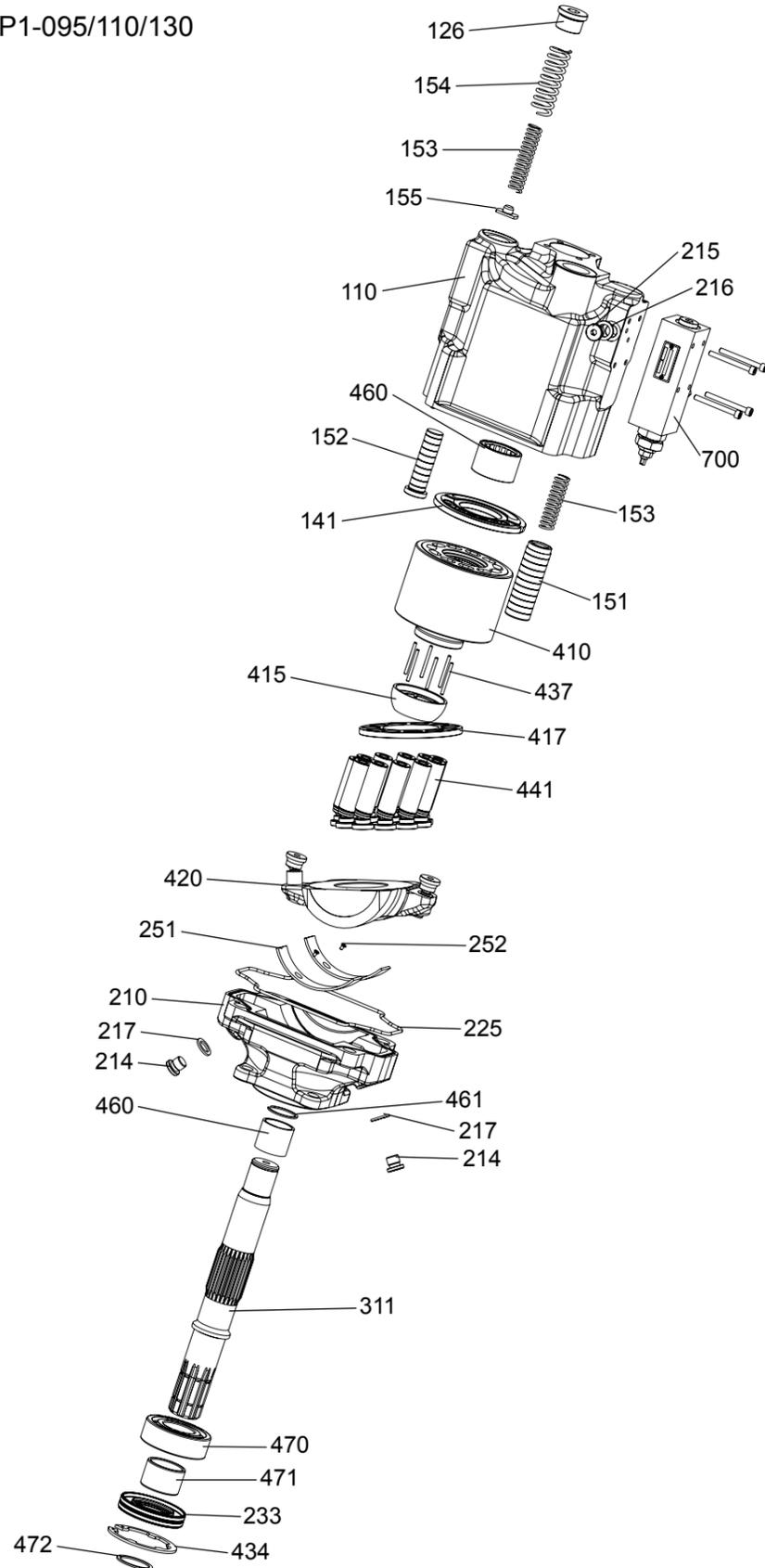
The spring in the cylinder barrel is compressed with a big force. When disassembling the retaining ring that lock the spring it might come out with a big force. Cylinder barrel is sold with the spring package assembled.

- 2:1 Assembly spring package (item 155, 153, 154 and 126).
- 2:2 Assembly the setting pistons and spring (item 153, 151 and 152).
- 2:3 Press down the bearing (item 460) to the barrel housing (item 111).
- 2:4 Assembly the valve plate (item 141). Fix it correct to the location pin in the barrel housing.
- 2:5 Assembly the pins (item 437) in the cylinder barrel item (410). Assembly the sphere (item 415) on the pins. The pins should fit to the sphere grooves.
- 2:6 Assembly the pistons (item 441) in the retainer ring (item 417). The sphere on the retainer ring shall be downwards. Assembly the piston package in the cylinder barrel package. Fit the cylinder barrel package in the barrel housing. The cylinder barrel shall be against the valve plate.



- 3:1 Place the swashplate (item 418) in the bearing housing. Make sure that the long setting piston arm on the swashplate is against the small setting piston. The leakage indication hole on the bearing housing shall be on the opposite side as the control. Push the swashplate against the bearing housing until the gears on the shaft is connected with the gears in the cylinder barrel. Torque the screws (item 246) to specified value.
- 3:2 Assembly the control (item 700) on the barrel housing. Torque to specified value.

Splitview VP1-095/110/130



Parts specification VP1-095/110/130

Item	Description
110	Barrel housing assy
126	Hex socket plug
141	Valve plate
151	Large setting piston
152	Small setting piston
153	Spring
154	Spring
155	Spring washer
210	Bearing housing
214	Hex socket plug
215	Hex socket plug
216	Seal washer
217	Seal washer
225	O-ring
233	Shaft seal
251	Bearing shell
252	Sunk head screw
311	Shaft
410	Cylinder barrel assy
415	Sphere
417	Slipper retainer
420	Swashplate assy
434	Retaining ring
437	Pin
441	Piston assy
460	Needle bearing
461	Retaining ring
470	Cylindrical bearing
471	Inner ring
472	Retaining ring
700	LS control



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